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Western Electric Co., Incorporated  
Equipment Engineering Branch, Hawthorne  
Printed in U.S.A.

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Issue 3 BT-431723  
Appendix 3  
February 14, 1938

This appendix was prepared from Issue 53 of Drawing T-431723.

METHOD OF OPERATION

Panel System - Signal Circuit - Miscellaneous Alarms - And Floor Alarm And  
Main Alarm Boards - And Power Alarm Cabinet

Add paragraph 50 which reads:-

50. INCOMING CALL SIGNAL LAMPS FOR CHIEF SWITCHMAN'S DESK AND O.G.T. TEST BOARD (FIG. 50)

Lamps (CS) and (TB) light at the floor alarm board, main alarm board or power alarm cabinet and a ringer is operated when a call comes to the chief switchman's desk or O.G.T. test board, respectively.

ENG.  
G.R.K.  
AR

CHK'D.  
G.R.K.

APP'D.  
C.A.MELSHEIMER  
S.C.E.

This Appendix was prepared from Issue 49 of Drawing 431723.

METHOD OF OPERATION  
SIGNAL CIRCUIT

Miscellaneous Alarms At Floor Alarm and Main Alarm Boards and Power Alarm Cabinet - Panel System.

Add Paragraphs 47, 48 and 49.

47. INFORMATION DESK TIME ALARM (FIG. 47)

47.1 When the information desk circuits fail to function properly after a predetermined length of time, a ground is connected to the "TA" and "DR" leads which lights the (DT) lamps and brings in the bells on the floor alarm board, power alarm cabinet, main alarm board or trouble desk.

48. AUDIBLE ALARM SWITCHING CIRCUIT FUSE (FIG. 48)

48.1 Operation of the 1 1/3 ampere fuse for the audible alarm switching circuit connects battery to the winding of relay (AF) operating it. Relay (AF) operated lights the (ASF) lamps and brings in the bells on the floor alarm board, power alarm cabinet, main alarm board or trouble desk.

49. PICK UP VOLTAGE ALARM (FIG. 49)

49.1 (BR-1), (BR-2) and (BR-3) relays are connected to pick-up brush No. 1, No. 2 and No. 3 respectively. These relays operate in rotation as the grounded segment of the interrupter makes contact with the brushes. If all relays are down at the same time due to an open brush, the (OB) relay releases to bring in an intermittent alarm. In order for the (OB) relay to reoperate, two (BR) relays must be operated. The (BR) relays are also capable of detecting grounded leads in the event that the PK. U.A. brush should become open. With the PK. U.A. brush open and a grounded lead or leads there will be some part of the cycle when all (BR) relays will be operated, releasing the (AB) relay which will bring in the alarms. Two (BR) relays must be released in order to reoperate the (AB) relay. A test jack (PU) is provided for use with the test set for testing relays (BR1), (BR2) and (BR3).

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Equipment Engineering Branch, Hawthorne.

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Appendix 1.  
May 31, 1927.

This Appendix was prepared from Issue 46 of Drawing T-431723.

METHOD OF OPERATION  
SIGNAL CIRCUIT

Miscellaneous Alarms at Floor Alarm and Main Alarm Boards and Power Alarm Cabinet - Panel Machine Switching System.

Add paragraph 46:

46. ALARMS WITH "P" WIRING

- 46.1 Closure of any circuit connected to the DC-2 lead operates the (DC-2) relay which operates the 10-D bell.
- 46.2 Closure of any circuit connected to the AC-2 lead operates the (AC-2) relay which operates the 43-F sub-set under control of the NA key.
- 46.3 Operation of the (SCA) relay causes operation of the 43-F sub-set under control of the NA key.

ENG: F.S.G.  
May 31, 1927.  
BMS

CHK'D. BY: D.C.W.

APP'D. BY: E. R. COOKE  
S.C.E.

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Equipment Engineering Branch, Hawthorne.

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issues.  
September 17, 1923 (\*)

This M. of O. was prepared from issue (32) of T-431723.

METHOD OF OPERATION  
SIGNAL CIRCUIT

Miscellaneous Alarms At Floor Alarm and Main Alarm Boards and Power Alarm Cabinet - Panel Machine Switching System. Paragraphs 40 to 45 Inclusive, District Motor Stop and Frame Busy Circuits.

DEVELOPMENT

1. PURPOSE OF CIRCUIT

- 1.1 This circuit is used to bring in audible and visible signals when a trouble condition or a circuit failure takes place in any of the more important parts of the machine switching equipment.

2. WORKING LIMITS

- 2.1 These circuits function with local circuits and have no working limits.

OPERATION

3. PRINCIPAL FUNCTIONS

- 3.1 In the event of a trouble condition or circuit failure, to notify the desk switchman or sender monitor promptly of the nature and approximate location of the trouble and of the progress being made to correct it, the signals at the trouble desk are in the nature of supervisory signals for enabling the switchman to take appropriate action if any alarm is left unattended for an undue length of time.
- 3.2 In addition to the alarm pilot equipment located at the trouble desk, there is provided on each floor a special panel known as a floor alarm board or power alarm cabinet, which mounts a set of alarm pilot signals associated with the equipment located on the corresponding floor.
- 3.3 To give distinctive audible signals for D.C. and S.C. failure.
- 3.4 To provide audible alarm signals when frame motors slow down below normal speed or stop.

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3.5 To provide visual signals when motors slow down below normal speed or stop.

3.6 To make the frames affected busy when motors slow down below normal speed.

#### 4. CONNECTING CIRCUITS

This circuit functions with:

4.01 The battery bus bars associated with the selector frames, selector repeating coil rack, line relay, ringing, tone, coin, distributing panel, charge and discharge fuses on battery fuse panel, power board, coin power, emergency lighting, and selector fuse panel or distributing fuse panel showing the greatest variation in voltage.

4.02 The ringing bus bars associated with the ringing generator, individual, two-party and four-party semi-selective machine ringing, positive super-imposed machine ringing and negative superimposed machine ringing.

4.03 Special "A" board auxiliary signal and night alarm circuit.

4.04 Motor stop and frame busy circuit.

4.05 Sender pulse machine circuit.

4.06 Senders busy circuit.

4.07 Circuit breakers and rectifiers.

4.08 Motor transfer alarm circuit.

4.09 Machine ringing pick-up leads.

4.10 Test Frames.

4.11 Start Circuit.

4.12 Emergency cordless key circuit.

4.13 A.C. power supply.

4.14 D.C. power supply.

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- 4.15 Selector time alarm.
- 4.16 Line Switch time alarm.
- 4.17 Full mechanical tandem allotter alarm.
- 4.18 Standard district selector circuits.
- 4.19 Standard "A" sender circuits.
- 4.20 Standard suburban sender circuits.
- 4.21 Standard "B" sender circuits.
- 4.22 Standard local tandem sender circuits.
- 4.23 Standard panel line finder circuits.

#### DETAILED DESCRIPTION

#### 5. SELECTOR FRAMES FUSE ALARM (FIG. 1)

- 5.1 The operation of a 24 volt of 48 volt fuse at a selector frame connects exchange battery to the winding of an (A) relay in series with a SEL. FR. lamp in the aisle, operating the relay and lighting the lamp. The (A) relay operated, operates the (A-1) relay. The (A-1) relay operated, lights a SEL. FR. lamp at the floor alarm board or power alarm cabinet and another at the trouble desk, each in series with an associated (AC) relay. The floor alarm board or power alarm cabinet (AC) relay operated, operates a 43-F subset ringer and the trouble desk (AC) relay operated, operates a buzzer. When the operated fuse is replaced, the (A) relay releases, extinguishing the aisle SEL. FR. lamp and releasing the (A-1) relay. The (A-1) relay released, extinguishes the floor alarm board or power alarm cabinet and the trouble desk SEL. FR. lamps and releases the associated (AC) relays, silencing the audible signals, if operating.

#### 6. MISCELLANEOUS - REPEATING COIL-LINE RELAY - RINGING - TONE - COIN BATTERY FUSE - CLOCK - FUSE ALARMS (FIG. 2)

##### 6.1 Miscellaneous Repeating Coil and Line Relay (48 Volt)

The operation of a 48 volt miscellaneous repeating coil and line relay fuse connects battery to the winding of an (A) relay ("a")

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wiring 85-F) ("b" wiring B151) in series with a designated lamp operating the relay and lighting the lamp. The (A) relay operated, operates the (A-1) relay. The (A-1) relay operated, lights a designated lamp at the floor alarm board or power alarm cabinet and another at the trouble desk, each in series with an associate (AC) relay which functions as in paragraph 5.1. When the operated fuse is replaced, the (A) relay releases and the designated lamp is extinguished, releasing the (A-1) relay. The (A-1) relay extinguishes the floor alarm board or power cabinet and the trouble desk designated lamps and releases the associated (AC) relays, silencing the ringer and buzzer, if operating.

#### 6.2 Miscellaneous Repeating Coil And Line Relay (24 Volt)

The operation of a 24 volt miscellaneous repeating coil and line relay fuse connects battery to the winding of an (A) relay ("a" wiring 85-F) ("b" wiring B151) in series with a designated lamp, operating the relay and lighting the lamp. The (A) relay operated, functions as in paragraph 6.1.

#### 6.3 Ringling

When fuse in ringling lead operates, ringling-current is connected to the winding of an "A" relay ("a" wiring 85-F) ("b" wiring B151) in series with 650 ohms resistance and a designated lamp, operating the relay and lighting the lamp. The (A) relay operated, functions as in paragraph 6.1.

#### 6.4 Tone

When a fuse in a tone lead operates, battery is connected to the winding of an (A) relay ("a" wiring 85-F) ("b" wiring B151) in series with a designated lamp, operating the relay and lighting the lamp. The (A) relay operated, functions as in paragraph 6.1.

#### 6.5 Clock

The operation of a fuse associated with the lead supplying ground to the clock circuits, operates the (A) relay (B305). The (A) relay operated operates the (A-1) relay and lights a designated lamp. The (A-1) relay operated, functions as in paragraph 6.1

#### 6.6 Negative Coin Battery

The operation of a fuse at the negative coin battery alarm bus bar, connects negative coin battery to the winding of the (A) relay ("a" wiring 85-F) ("b" wiring B151) in series with 960 ohms resistance and a designated lamp operating the relay and lighting the lamp. The (A) relay operated, functions as in paragraph 6.1.

#### 6.7 Positive Coin Battery

The operation of a fuse at the positive coin battery alarm bus bar, connects positive coin battery to the winding of the (+A) relay in series with 960 ohms resistance and a designated lamp, operating the relay and lighting the lamp. The (+A) relay operated operates the (A-1) relay which functions as in paragraph 6.1.

### 7. DISTRIBUTING PANEL FUSES (FIG. 3)

- 7.1 The operation of a fuse at a battery distributing panel connects exchange battery to the winding of the (A) relay operating the relay. The (A) relay operated, lights a DISTRIBUTING FUSE PANEL lamp at the floor alarm board or power alarm cabinet and another at the trouble desk each in series with an associated (DCH) relay. The (DCH) relays operated, operate a bell at the floor alarm board and a bell at the trouble desk respectively. When the operated fuse is replaced, the (A) relay releases, extinguishing the DISTRIBUTING FUSE PANEL lamps and releasing the (DCH) relays, silencing the bells.

### 8. CHARGE AND DISCHARGE FUSES (FIGS. 4 & 35)

#### 8.1 Charge Fuse

The operation of a heavy duty charging fuse at a battery fuse panel connects the winding of the (A) relay to the battery under charge, operating the relay. The (A) relay operated, lights the CHARGING FUSES lamp at the floor alarm board or power alarm cabinet in series with the (AC) relay operating the 43-F subset ringer at the floor alarm board or power alarm cabinet and also lights the Charging Fuses lamp at the trouble desk in series with the (AC) relay, operating a buzzer at the trouble desk.

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#### 8. Discharge Fuse

The operation of a discharge fuse in a battery distributing panel operates the (A) relay, lighting the floor alarm board or power cabinet and trouble desk DISCHARGE FUSE lamps and performing the functions similar to those described above.

- 8.3 The replacement of the operated fuse releases the (A) relay, extinguishing the lamps and releasing the (AC) relays silencing the ringer and buzzer.

#### 9. SPECIAL "A" BOARD AUXILIARY SIGNAL AND NIGHT ALARM (FIG. 5)

- 9.1 When a fuse in a special "A" board section operates, ground from the special "A" board auxiliary signal and night alarm circuit is connected to a designated lamp at the trouble desk in series with the (AC) relay, lighting the lamp and operating the relay in turn operating the trouble desk buzzer. When the operated fuse is replaced, the ground is removed releasing the (AC) relay and extinguishing the lamp at the trouble desk. The (AC) relay released silences the buzzer.

#### 10. FRAME MOTOR STOP ALARM (FIGS. 6.7)

- 10.1 When the stop contact of an alarm governor makes due to the motor stopping or slowing down below its normal minimum rated speed, a relay in the motor stop and frame busy circuit operates. This relay operated, lights the red motor stop lamp and operates the (AC) relays which in turn operate the buzzer at the trouble desk and at the floor alarm board or power alarm cabinet. When the motor stop key is operated, the white motor stop guard lamp at the floor alarm board or power alarm cabinet lights, indicating that the stop alarm has been removed and releases the relay in the motor stop circuit, extinguishing the trouble desk and floor alarm board or power alarm cabinet red lamp and silencing the buzzer and ringer. When the motor again runs at its normal rated speed the stop circuit connects ground to the lead, lighting the red motor stop lamp at the trouble desk or at the floor alarm board or power alarm cabinet and operating the (AC) relays, which in turn operate the buzzer at trouble desk and ringer at the floor alarm board or power alarm cabinet.

10.2 The release of the motor stop key extinguishes the white guard lamp and releases the relay in the motor stop circuit, extinguishing the red guard lamps and releasing the (AC) relays which in turn silences the buzzer and ringer.

11. FRAME BUSY GUARD (FIG. 8)

11.1 The operation of a frame busy key at a district frame operates a relay in the motor stop and frame busy circuit making busy each group of districts on the same side of the frame, and lighting a green FRAME BUSY lamp at the floor alarm board or power alarm cabinet in series with the (FBG) relay which operates. The (FBG) relay operated, lights a green FRAME BUSY GUARD pilot lamp at the trouble desk.

11.2 The release of the frame busy key removes the busy condition from the district frame groups extinguishing the floor alarm board or power alarm cabinet lamp and releases the (FBG) relay, extinguishing the trouble desk lamp.

12. SENDER PULSE FUSE ALARM (FIG. 9)

12.1 The operation of a fuse at the alarm bar of the sender fuse alarm circuit connects ground to SDR. PULSE FUSE ALARM LAMPS at the floor alarm board or power alarm cabinet and at the trouble desk in series with associated (AC) relays, operating the relays. The trouble desk (AC) relay operated, operates a buzzer and the floor alarm board or power alarm cabinet (AC) relay operated, operates a ringer. When the operated fuse is replaced, ground is removed, extinguishing the SDR. PULSE FUSE ALARM lamps and releasing the (AC) relays, silencing the buzzer and ringer.

13. SENDERS BUSY (FIG. 10)

13.1 When it is desired to determine the number of busy senders the gang key at the floor board or power alarm cabinet is operated. Each busy sender associated with the key connects ground to its SDR. BUSY lamp which lights. When the gang key is restored the busy lamps are extinguished.

14. CIRCUIT BREAKER ALARM (FIG. 11)

14.1 When a circuit breaker (in the power charging circuit not shown in this drawing) trips, the (CB) or (R) relay is connected

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to the battery being charged, operating the relay. This relay operated, lights the CIRCUIT BREAKER lamps at the floor alarm board or power alarm cabinet and trouble desk in series with their (AC) relays operating the 43-F subset ringer and the buzzer.

- 14.2 When the circuit breaker is closed the (CB) or (R) relay releases, extinguishing the lamps and releasing the (AC) relays, silencing the ringer and buzzer.

15. PULSE MACHINE ALARM (FIG. 12)

- 15.1 The operation of a pulse lead or a ground supply fuse or the crossing of a pulse lead with battery in the pulse machine battery alarm circuit, causes the operation of the (PMAL) relay, in series with the "A" or "B" fuse alarm lamp and the "A" or "B" battery alarm lamp. (Duplicate sets of apparatus provided for the "A" and "B" pulse drums and leads). The (PMAL) relay operated, operates the floor alarm board or power cabinet bell and operates the (AC) relay in series with PULSE MACHINE lamp which lights at the trouble desk. The (AC) relay operated, operates the trouble desk buzzer.

- 15.2 When the trouble is cleared in the case of a pulse lead crossed from battery or when the operated fuse is replaced, the (PMAL) relay releases, extinguishing the "A" or "B" battery or fuse lamp. The (PMAL) relay released silences the floor alarm board and trouble desk bells and extinguishes the PULSE MACHINE lamp at the trouble desk.

16. TRANSFER ALARM FOR INDIVIDUAL DUPLEX MOTOR (FIG. 13)

- 16.1 When an individual frame duplex motor fails, a circuit is closed from ground at the normally operated duplex motor master switch, through the MOTOR TRNS. lamp at the floor alarm board or power alarm cabinet, in series with 600 ohms resistance paralleled by a 500 ohm resistance to terminal #2 of the three pole receptacle on the selector frame motor box, over the patching cord to terminal #2 of the three pole plug at the motor, through the AC motor unit, to the #3 terminal of the three-pole plug at the motor, over the patching cord to #3 terminal of the three-pole receptacle to exchange d.c. battery, lighting the MOTOR TRNS. lamp as an indication that an individual duplex frame drive motor has been transferred from the outside A.C. supply to the exchange d.c. supply.

- 16.2 When the individual frame duplex motor is restored to service, the circuit is automatically opened, disconnecting the d.c. battery supply and extinguishing the MOTOR TRANS. lamp.
17. POWER TRANSFER ALARM - FOR INDIVIDUAL COMBINED COIN COLLECT AND RINGING GENERATOR - THREE-UNIT SET (FIG. 14)
- 17.1 When an individual frame duplex motor fails, a circuit is closed from battery at the starting contactor located in the A.C. control equipment, through the (CCR) resistance, (CCR) at the floor alarm board or power alarm cabinet, winding of the (PTA) relay to ground at the normally operated duplex motor master switch, operating the relay and lighting the lamp. The (PTA) relay operated, operates the d.c. bell at the floor alarm board or power alarm cabinet, and lights the (CO-R) lamp at the trouble desk in series with the (DC) relay which operates, ringing the trouble desk bell.
- 17.2 When the individual frame duplex motor is restored to service, the circuit is automatically opened at the A.C. control equipment releasing the (PTA) relay and extinguishing the floor alarm board or power alarm cabinet (CCR) lamp. The (PTA) relay released, silences the floor alarm board or power alarm cabinet bell and releases the trouble desk (DC) relay silencing the trouble desk bell.
18. A. C. FAILURE DUPLEX MOTORS (FIG. 15)
- 18.1 When the A.C. power service fails or when the voltage varies beyond predetermined limits so as to affect the frame duplex drive motors, the master switch associated with the duplex motors operates making inoperative the individual transfer alarm of figs. 13 and 14 and operating the (MSF) relay. The (MSF) relay operated, closes a circuit from ground at its make contact, through the normal master switch guard key, MASTER SWITCH alarm lamp at the floor alarm board and power alarm cabinet, winding of the (MSA) relay to battery, lighting the lamp and operating the relay. The (MSA) relay operated, brings in the bell at the floor alarm board or power alarm cabinet and connects ground to the trouble desk MASTER SWITCH alarm lamp and (DC) relay, lighting the lamp and operating the relay which in turn brings in the trouble desk alarm bell.

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18.2 When the master switch guard key is operated the circuit is opened, extinguishing the floor alarm board or power alarm cabinet MASTER SWITCH alarm lamp, and releasing the (MSA) relay which in turn silences the floor alarm board or power alarm cabinet bell and releases the (DC) relay and extinguishes the trouble desk MASTER SWITCH alarm master switch guard key operated, lights a MASTER SWITCH guard lamp at the floor alarm board or power alarm cabinet as an indication that the duplex drive motors are running on exchange battery.

18.3 When the A.C. power service is restored or when the voltage is between its proper limits, the master switch of the motors is released, releasing the (MSF) relay. With the (MSF) relay released and the guard key operated, the (MSA) relay is operated bringing in the floor alarm board or the power alarm cabinet and the trouble desk signals and alarms as in paragraph 18.1. These signals together with the lighted guard lamp indicate that A.C. service has been restored. The guard key is then restored, releasing the (MSA) relay, extinguishing the lighted lamps and silencing the bells as in paragraph 18.2.

19. PICK-UP ALARM (FIG. 16)

19.1 If an incoming selector frame pick-up ringing lead becomes grounded between the pick-up lead resistance lamp and the selector frame, the (PU) relay operates in series with the pick-up lead lamp which lights as an indication of the selector group in trouble. The (PU) relay operated, lights PICK-UP alarm lamps at the floor alarm board, or power alarm cabinet and at the trouble desk in series with their respective (AC) relays which bring in a bell and buzzer at the alarm board or trouble desk. When the pick-up lead is cleared, the (PU) relay releases, extinguishing the PICK-UP lamps and releasing the (AC) relays, in turn silencing the ringer and buzzer.

20. TEST FRAME ALARM (FIG. 17)

20.1 When an automatic test circuit fails to complete a routine test due to a failure of itself or in the circuit under test, the (TF) relay operates in series with the test frame alarm which lights. The (TF) relay operated, ("Y" Wiring) operates the (TF-1) relay which lights TEST FRAME alarm lamps at the floor alarm board or power alarm cabinet and at the

trouble desk in series with associated (AC) relays which bring in a ringer and buzzer at the alarm board or cabinet and trouble desk. When the test circuit restores to normal or proceeds with the test, the (TF) relay releases, releasing the (TF-1) relay, extinguishing the TEST FRAME lamps and releasing the (AC) relays, in turn silencing the ringer and buzzer.

21. POWER BOARD FUSE ALARM (FIG. 18)

21.1 The operation of a 24 or 48 volt fuse at the power board operates the power alarm cabinet (E458) relay. This relay operated lights designated lamps at the floor alarm board or power alarm cabinet and trouble desk in series with associated (DCH) relays which bring in bell alarms.

21.2 The replacement of the operated fuse releases the E458 relay, extinguishing the lamps and releasing the (DCH) relays, silencing the bells.

22. COIN POWER FAILURE ALARM (FIG. 19)

22.1 Positive Coin Battery

When positive coin battery fails, the (+CB) relay releases operating the (CBA) relay in series with the floor alarm board or power alarm cabinet (CC+) lamp and associated (AC) relay, lighting the lamp and operating the relay. The (AC) relay operated, brings in the alarm board or cabinet ringer. The (CBA) relay operated lights the trouble desk COIN POWER FAILURE lamp and operates the associated (AC) relay bringing in the trouble desk buzzer. When the positive coin battery is restored, the (+CB) relay operates, releasing the (CBA) and floor alarm board or power alarm cabinet (AC) relay silencing the ringer and extinguishing the (CC+) lamp. The (CBA) relay released, extinguishes the trouble desk COIN POWER FAILURE lamp and releases the (AC) relay, silencing the buzzer.

22.2 Negative Coin Battery

When negative coin battery fails, the (-CB) relay releases, operating the (CBA) relay in series with the (CC-1) lamp similar to paragraph 22.1.

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23. START CIRCUIT ALARM (FIG. 20)

23.1 In case the start circuit fails to release within a pre-determined length of time, the start circuit (KA) relay operates and is held operated to ground on the trouble desk start circuit alarm release key. The (KA) relay operated lights the START CIRCUIT alarm lamp at the trouble desk in series with the (SCA) relay which operates, in turn operating the trouble desk auxiliary signal circuit buzzer.

23.2 When the trouble desk start circuit alarm release key is operated, the start circuit (KS) relay releases, extinguishing the trouble desk START CIRCUIT alarm lamp and releasing the (SCA) relay in turn silencing the buzzer.

24. EMERGENCY "B" SENDER ALARM (FIG. 21)

24.1 If machine switching "B" (cordless emergency sender equipment is required, a key at the machine switching "B" board is operated, lighting the CORDLESS EM. lamp in series with the (EM) relay, operating the relay. The (EM) relay operated brings in a bell at the floor alarm board and lights the trouble desk CORDLESS EMERGENCY lamp in series with the (EM) relay, which operates, closing the trouble desk audible alarm circuit.

24.2 When the key is released at the cordless position the floor alarm board CORDLESS EM. lamp is extinguished and the (EM) relay is released in turn extinguishing the trouble desk lamp and releasing the (EM) relay opening the trouble desk audible alarm circuit.

25. PULSE MACHINE MOTOR STOP ALARM (FIG. 22)

25.1 When the stop contact of an alarm governor makes due to the motor stopping or slowing down below its normal minimum rated speed, a relay in the pulse machine motor stop circuit operates. This relay operated, connects ground to the red PULSE MACHINE MOTOR STOP lamp and to the bell at the floor alarm board, lighting the lamp and operating the bell and also connects ground to the red PULSE MACHINE MOTOR STOP lamp in series with the (DCH) relay at the trouble desk, lighting the lamp and operating the relay in turn bringing in the trouble desk bell.

25.2 When the motor again runs at its normal rates speed, the pulse machine motor stop circuit relay releases, extinguishing the floor alarm board or power alarm cabinet red PULSE MACHINE MOTOR STOP lamp and silencing the ringer and also extinguishing the trouble desk red PULSE MACHINE MOTOR STOP lamp and releasing the (DCH) relay in turn silencing the trouble desk bell.

26. A.C. POWER FAILURE (FIG. 23)

26.1 The failure of one or more phases in the A.C. power leads causes the phase failure device to operate, releasing the (ACF) relay. The (ACF) relay normal, operates the (ACFA) relay from ground, winding, normal (ACF) relay, normal A.C. power phase failure guard key, A.C. POWER FAILURE lamp at the floor alarm board or at the power alarm cabinet, winding of the (DC) relay to battery, lighting the lamp and operating the relay. The (DC) relay operated brings in the floor alarm board or power alarm cabinet bell. The (ACFA) relay operated, closes a circuit through the normal A.C. power phase failure guard key to light the trouble desk A.C. POWER FAILURE lamp in series with the (DC) relay which operates bringing in the trouble desk bell.

26.2 The operation of the phase failure guard key releases the (ACFA) relay and transfers the floor alarm board or power alarm cabinet and trouble desk signals to the front contact of the (ACF) relay extinguishing the lamps and releasing their associated (DC) relays extinguishing the bells. The operate key lights an A.C. POWER FAILURE guard lamp.

26.3 When the A.C. service is restored, the phase failure device operates, in turn operating the (ACF) relay. With the (ACF) relay and the phase failure guard key operated, the (ACFA) relay is operated, bringing in the alarms as in paragraph 26.1. When the key is restored, the A.C. power failure guard lamp is extinguished and the floor board or power alarm cabinet and trouble desk signals are restored as in paragraph 26.2.

27. D.C. POWER FAILURE (FIG. 24)

27.1 The failure of the D.C. power causes the release of a relay in the power control circuit which in turn operates the (DCA) relay. The (DCA) relay operated, closes a circuit from ground, operated

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(DCA) relay, normal D.C. service failure guard key, floor alarm board or power alarm cabinet D.C. SERVICE FAILURE lamp, winding of the (DCF) relay to battery, lighting the lamp and operating the relay. The (DCF) relay operated, brings in the floor alarm board or power alarm cabinet bell and lights the trouble desk D.C. SERVICE FAILURE lamp in series with the (DC) relay which operates in turn bringing in the trouble desk bell.

27.2 The operation of the D.C. service failure guard key transfers the circuit for the (DCF) relay from the back to the front contact of the (DCA) relay, extinguishing the floor alarm board or power alarm cabinet D.C. SERVICE FAILURE lamp and releasing the (DCF) relay which in turn silences the floor alarm board or power alarm cabinet bell and extinguishes the trouble desk D.C. SERVICE FAILURE lamp and releases the (DC) relay in turn silencing the trouble desk bell. The key operated, lights a D.C. service failure guard lamp.

27.3 When the D.C. service is restored, the power control relay operates, releasing the (DCA) relay. With the (DCA) relay and the D.C. service failure guard key operated, the (DCF) relay is operated, bringing in the alarms as in paragraph 27.1. When the key is restored the D.C. SERVICE FAILURE guard lamp is extinguished and the floor alarm board or power alarm cabinet and trouble desk signals are restored as in paragraph 27.2.

## 28. EMERGENCY LIGHTING FUSE ALARM (FIG. 25)

28.1 If an emergency lighting fuse operates, the (EL) relay releases, closing a circuit to operate the (ELA) relay from ground, winding normal (EL) relay, floor alarm board or power alarm cabinet EMERGENCY LIGHTING FUSE lamp winding of the (AC) relay, bringing in the floor alarm board or power alarm cabinet ringer. The (ELA) relay operated, lights the trouble desk EMERGENCY LIGHTING FUSE lamp in series with its (AC) relay bringing in the trouble desk buzzer.

28.2 When the operated emergency lighting fuse has been replaced, the (EL) relay operates, releasing the (ELA) relay, extinguishing the lamps and releasing their associated (AC) relays, in turn silencing the floor alarm board or power alarm cabinet ringer and silencing the trouble desk buzzer.

29. SELECTOR OR LINE FINDER TIME ALARM (FIG. 26)

29.1 In case a selector or line finder fails to release within a predetermined length of time, the selector or line finder (A) relay operates, connecting ground to the designated alarm lamps in series with their associated (AC) relays at the floor alarm board or power alarm cabinet and at the trouble desk lighting the lamps and operating the relays. The relays operated, bring in their associated ringer and buzzer.

29.2 When the selector or line finder releases, the (A) relay is released, in turn extinguishing the lamps and releasing the (AC) relays, silencing the ringer and buzzer.

30. LINE SWITCH ALARM (FIG. 27)

30.1 In case the (DS) brush of an individual line switch becomes grounded as the switch hunts for an idle district, a relay in the line switch alarm circuit operates then locks to ground over lead B through the line switch alarm release key. The line switch alarm circuit relay operated, lights the LINE SWITCH ALARM lamp at the floor alarm board or power alarm cabinet over lead A in series with the (LS) relay which operates. The (LS) relay operated, operates the (LS-1) relay. The (LS-1) relay operated, lights the LINE SWITCH ALARM lamp at the trouble desk in series with the (AC) relay which operates, operating a buzzer at the trouble desk. The (LS-1) relay operated, also rings the bell at the floor alarm board or power alarm cabinet.

30.2 The LINE SWITCH ALARM RELEASE key is released after the individual line switch has been cleared of trouble, releasing the line switch alarm circuit relay in turn releasing the (LS) and (LS-1) relays and extinguishing the floor alarm board LINE SWITCH lamp and silencing the 43-F subset ringer and extinguishing the trouble desk LINE SWITCH lamp and releasing the (AC) relay, silencing the buzzer.

31. VOLTAGE ALARMS (FIG. 28)

31.1 High Voltage - When the potential across the coils of the Weston voltmeter relay equals 49.9 volts, the (C) and (LC-50) contacts of the voltmeter relay close and the (H) relay operates. The (H) relay operated, operates the (HL) relay in series with

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the HIGH VOLTAGE lamp at the floor alarm board or power alarm cabinet and the winding of the (AC) relay, lighting the lamp and operating the (AC) relay. The (AC) relay operated, operates the ringer at the floor alarm board or power alarm cabinet. The (HL) relay operated, also lights the VOLTAGE LAMP at the trouble desk in series with the (AC) relay. The (AC) relay operated, operates the buzzer at the trouble desk. When the potential drops below 49.9 volts, the (H) relay releases, releasing the (HL) and (AC) relays. The (HL) relay released, extinguishes the lamps and the (AC) relay released, silences the ringer and buzzer.

31.2 Low Voltage - When the potential equals 45.1 volts, contacts (C) and (LC-45) of the voltmeter relay close and the (L) relay operates. The (L) relay operated, operates the (HL) relay in series with the LOW VOLTAGE lamp at the floor alarm board or power alarm cabinet and the winding of the (AC) relay, lighting the lamp and operating the (AC) relay. The (HL) relay operated, lights the trouble desk VOLTAGE LAMP in series with the (AC) relay as in paragraph 31.1. When the potential exceeds 45.1 volts, the (L) relay releases, releasing the (HL) relay, extinguishing the lamps and releasing the (AC) relays, silencing the alarms as in paragraph 31.1.

31.3 The adjustment of the contacts of the Weston 30 voltmeter relay should be such that when the potential is between the limits of 45.1 and 49.1 volts, the (L) and (H) relays do not operate. Ground is connected to the C arm of the voltmeter relay through the 18-AF resistance to reduce sparking at the contacts.

#### RINGING MACHINE ALARM (FIGS. 29, 30, 31, 32)

#### 32. RINGING GENERATOR (FIG. 29)

32.1 The failure of ringing generator current, releases the (RG) relay. The (RG) relay released, operates the (RMA) relay in series with the RINGING GENERATOR lamp at the floor alarm board or power alarm cabinet and the (DC) relay, lighting the lamp and operating the relay. The (DC) relay operated, operates the bell at the floor alarm board or power alarm cabinet. The (RMA) relay operated, lights the trouble desk RINGING lamp in series with its (DC) relay which operates, operating a buzzer at the trouble desk.

32.2 When ringing generator current is restored, the (RG) relay operates, extinguishing the RINGING GENERATOR lamp and releasing the (RMA) and (DC) relays. The (RMA) relay released, extinguishes the trouble desk RINGING lamp and releases the (DC) relay. The (DC) relays released, silence the ringer and the buzzer at the floor alarm board or power alarm cabinet and at the trouble desk respectively.

33. INDIVIDUAL TWO-PARTY AND FOUR-PARTY SEMI-SELECTIVE MACHINE RINGING (FIG. 30)

33.1 The failure of machine ringing current releases the (MR) relay. The (MR) relay released, releases the (MR-1) relay. The (MR-1) relay released, operates the (RMA) relay in series with the MACHINE RINGING lamp at the floor alarm board or power alarm cabinet and in series with the winding of the (DC) relay, lighting the lamp and operating the (DC) relay. The (DC) relay operated, operates the bell. The (RMA) relay operated, lights the RINGING lamp at the trouble desk in series with the winding of the (DC) relay which operates. The (DC) relay operated, operates the bell. The (MR-1) relay is made slow acting to prevent its release in case the (MR) relay releases momentarily on machine ringing alternating current.

33.2 When machine ringing current is restored, the (MR) relay operates, operating the (MR-1) relay, extinguishing the MACHINE RINGING LAMP and releasing the (RMA) relay in turn extinguishing the RINGING LAMP and releasing the (DC) relays, silencing the bells.

34. POSITIVE SUPERIMPOSED MACHINE RINGING (FIG. 31)

34.1 The failure of positive superimposed machine ringing current releases the (+MR) relay in turn releasing the (+MR1) relay. The (+MR1) relay released, operates the (RMA) relay as in paragraph 33.1 in series with the floor alarm board or power alarm cabinet designated lamp. When machine ringing current is restored, the (+MR) relay operates, in turn operating the (+MR1) relay extinguishing the lamps and silencing the bells.

35. NEGATIVE SUPERIMPOSED MACHINE RINGING (FIG. 32)

35.1 The failure of negative superimposed machine ringing current releases the (-MR) relay in turn releasing the (-MR1) relay. The (-MR1) relay released, operates the (RMA) relay as in paragraph

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33.1 in series with the floor alarm board or power alarm cabinet designated lamp. When machine ringing current is restored, the (-MR) relay operates, in turn operating the (-MR1) relay, extinguishing the lamps and silencing the bells.

36. POWER BOARD HOWLER FUSE ALARM (FIG. 33)

36.1 The operation of a power board howler fuse operates the (HFA) relay. The (HFA) relay operated, closes circuits to light the HOWLER FUSE alarm lamps in series with their associated (AC) relays at the floor alarm board or power alarm cabinet and at the trouble desk. The (AC) relays operated, bring in a ringer at the floor alarm board or power alarm cabinet, and a buzzer at the trouble desk.

36.2 The replacement of the operated fuse releases the (HFA) relay, extinguishing the HOWLER FUSE lamps and releasing the (AC) relays, silencing the ringer and the buzzer.

37. RELAY PROTECTION (FIGS. 1 AND 2)

37.1 In order to protect the (A) relay windings which feed direct ground through their winding, a fuse is provided having a 240 ohm resistance to battery on the alarm bar. In case a short circuit takes place in the lead between the relay winding and various bus bars the fuse is operated in turn operating the (A) relay to 240 ohm battery bringing in the alarms.

38. FULL MECHANICAL TANDEM ALLOTTER ALARM (FIG. 34)

38.1 When the Full Mechanical Tandem Allotter and Link Circuit does not function properly within a predetermined time limit, ground is connected to the (DC) relay at trouble desk through a lamp causing a visible and audible signal to function. When allotter alarm circuit is returned to normal by maintenance attendant, the visible and audible alarm is returned to normal.

39. CHARGE AND DISCHARGE FUSE (FIG. 35)

39.1 Charge Fuse

The operation of a heavy duty charging fuse at a battery fuse panel connects the winding of the (A) relay to the battery

under charge, operating the relay. The (A) relay operated, lights the CHARGING FUSES lamp at the floor alarm board or power alarm cabinet in series with the (AC) relay operating the 43-F subset ringer at the floor alarm board or power alarm cabinet and also lights the Charging Fuses lamp at the trouble desk in series with the (AC) relay, operating a buzzer at the trouble desk.

#### 39.2 Discharge Fuse

The operation of a discharge fuse in a battery distributing panel operates the (A) relay, lighting the floor alarm board or power cabinet and trouble desk DISCHARGE FUSE lamps and performing the functions similar to those described above.

- 39.3 The replacement of the operated fuse releases the (A) relay extinguishing the lamps and releasing the (AC) relays silencing the ringer and buzzer.

#### 40. ALARM GOVERNOR FOR FRAME DRIVE MOTORS

- 40.1 Each frame drive motor is provided with a double throw centrifugal contact switch, located on the motor shaft. While the motor is running at or above its normal speed the contact is held closed to the "run" position due to centrifugal force. Below this normal speed, the force is not sufficient to hold the switch operated to the "run" contact and switch closes to the "stop" contact. The spring of the switch is adjustable within certain limits and is to be set so that the contact changes from the "run" to the "stop" position, when the speed is between 75% and 95% of the normal motor speed.

#### 41. DISTRICT MOTOR STOP AND FRAME BUSY FIGURE 1

- 41.1 When the district frame drive motor slows down sufficiently below its normal speed, the "stop" contact closes to ground operating the (MS) relay and the (FB) relays. The (MS) relay operated lights the Main Alarm Board "Motor Stop Pilot" lamp (red) and the Floor Board "Motor Stop" lamp (red). The (FB) relays operated disconnect battery from the test leads to the line switches and connect ground to the test leads as a busy condition.

- 41.2 The operation of the (MS) key lights the floor board "Motor Stop Guard" lamp (white) and releases the (MS) relay. The (MS) relay released extinguishes the main and floor alarm board "Motor Stop Pilot" and "Motor Stop" lamps.

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41.3 When the motor again runs at or above its normal speed the "Stop" contact is opened and the "Run" contact is closed. The "Stop" contact opened releases the (FB) relays. The (FB) relays released removed ground from the test leads and connects battery to the leads. The "Run" contact closed reoperates the (MS) relay. The (MS) relay operated again, lights the main alarm board "Motor Stop Pilot" and floor alarm board "Motor Stop" lamps as signals that the motor is again running at its normal speed. The (MS) key released releases the (MS) relay extinguishing the lamps and restoring the circuit to normal.

41.4 The operation of the (FB) keys operates the (FB) relays if unoperated or holds them operated if they are already operated. The (FB) relays operated function as described in paragraph 6.

41.5 In case of cable failure i.e. cable becoming grounded, the (L) relay operates in series with the secondary winding of the (FB) relay. The (L) relay operated lights the "Floor Board Frame Busy" lamp (green). The (FB) relay operated functions as described in paragraph 6. When the ground has been removed from the cable the (L) and (FB) relays release and the circuit is restored to normal.

NOTE: The cable failure circuit has not been designed yet and the operation of the (L) and (FB) relays is based on the supposition that the cable failure circuit will function in this manner.

#### 42. MISCELLANEOUS FRAME MOTOR STOP AND FRAME BUSY FIGURE 2

42.1 When a miscellaneous frame drive motor slows down sufficiently below its normal speed the stop contact closes operating the (MS) relay and the other relays in parallel with it. The (MS) relay operated functions as described in paragraph 6. The (FB) relay (Y-1 wiring) operated connects ground to the common (MB) leads of the ("A" senders). The (FB) relay (X wiring) operated connects ground to the (MB) leads of the suburban and "A" senders. The (FB-1) and (FB-2) relays operated connect ground to the individual (MB) leads of the "A" senders.

42.3 With the (MS) key operated the circuit functions as described in paragraph 6. When the motor again runs at or above its normal speed the "stop" contact opens and the "run" contact closes. The (MS) relay now functions as described in paragraph 8 and the other relays release.

43. "B" SENDER AND LOCAL TANDEM SENDER MOTOR STOP AND FRAME BUSY FIGURE 3

43.1 When the "B" sender and local tandem sender drive motor slows down sufficiently below normal speed the "Stop" contact closes operating the (MS) relay and any other relays in parallel with it. The (MS) relay operated functions as described in paragraph 6. The (SB) and (SB-1) relays (X wiring) operated connect ground to the sender leads. The (SB) relay (Y wiring) operated connects ground to the lead to the (PB) relays and to the (MB) jack of the senders. The (SB) relay (Z wiring) connects ground to the leads to the senders.

43.2 When the (MS) key is operated the (MS) relay functions as described in paragraph 7. When the motor again runs at or above normal speed the (MS) relay reoperates and the other relays in the circuit release. From this point the operation of the circuit is the same as described in paragraph 8 when the (MS) key is restored to normal.

44. PANEL LINE FINDER AND DISTRICT MOTOR STOP FIGURE 4

44.1 When the panel line finder and district drive motor slows down sufficiently below its normal speed the stop contact closes operating the (MS) relay and the (FB) relays. The (MS) relay operated functions as described in paragraph 6. The (FB) relays operated connect ground to the (MB) leads of the line finders. The operation of the (MS) key causes the (MS) relay to function as described in paragraph 7. When the motor again runs at or above normal speed the (FB) relays release and the (MS) relay functions as described in paragraph 8.

45. MOTOR STOP ALARM FOR PULSE MACHINES FIGURE 5

45.1 When the pulse machine slows down sufficiently below the normal speed the contact closes operating the (PF) relay. The (PF) relay operated operates the bell at the floor alarm board or power alarm cabinet, and lights the "Motor Stop" lamp at the floor alarm board or power alarm cabinet and the lamp at the trouble desk. When the motor again runs at or above its normal speed the contact opens and the (PF) relay releases, extinguishing the lamps and stopping the ringing of the bell.

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45.2      The circuits are wired through a spare unit on each of the transfer keys, one circuit provided for the "A" drums and the other for the "B" drums. The motor stop contacts on each of the machines are wired to corresponding terminals on the key units so that any one of the three machines can be connected to either motor stop alarm circuit for the "A" or "B" drums.

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January 30, 1925.

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